

Appl. No. 10/820,856
Amendment dated: February 16, 2007
Reply to OA of: November 16, 2006

REMARKS

This is in response to the Official Action of November 16, 2006 in connection with the above-identified application. Applicants have amended the claims in order to more precisely define the scope of the present invention.

Specifically, Applicants have amended claim 1 to incorporate the subject matter of claim 2. Accordingly, claim 1 now recites a second barrier layer comprising tin and copper wherein the quantity of copper is larger than that of tin. In light of this amendment, claim 2 has been canceled. Applicants also note that claims 5 and 6 have been canceled without prejudice or disclaimer.

Turning now the outstanding Official Action, the Official Action begins by rejecting claims 5 and 6 under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. Applicants note that claims 5 and 6 have been canceled from the instant application, and therefore the §112, first paragraph, rejection has been rendered moot. Accordingly, it is respectfully requested that this rejection be withdrawn.

The rejection of claims 1, 2 and 4 under 35 U.S.C. §102(b) as being anticipated by Mis et al. (US Pat. No. 5,767,010) has been carefully considered but is most respectfully traversed in light of the following comments.

Applicants wish to direct the Examiner's attention to MPEP § 2131 which states that to anticipate a claim, the reference must teach every element of the claim.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed Cir. 1989). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed.Cir. 1990).

The Official Action urges that Mis discloses every element of claim 1, including an under bump metallization structure comprising an adhesive layer 28, a first barrier

layer 30, a wetting layer 32 and a second barrier layer 34' wherein the second barrier layer comprises tin and copper. Applicants respectfully traverse this rejection, and specifically traverse the position that Mis discloses a second barrier layer comprising tin and copper.

Applicants begin by noting that Mis discloses at col. 4, lines 11-22 that copper layer 34 is a part of the under bump metallurgy layer, along with the chromium layer 30 and phased layer 32. Also as stated at col. 4, lines 11-22, the purpose of the under bump metallurgy layer is to provide adequate adhesion between a solder pad and a contact pad. The top layer in an under bump metallurgy layer often serves the purpose of preventing the solder material from reacting with lower layers in the UBM layer during the formation of a solder ball. It is important to prevent the reaction of the solder material with lower layers in the UBM layer because this can adversely affect the ability of the UBM layer to adhere the solder ball to the contact pad. Because the top layer of the UBM is used to prevent reactions with lower layers of the UBM, the top layer is often referred to as a barrier layer. Accordingly, Applicants respectfully submit that in order to be reasonably interpreted as a barrier layer of a UBM, a reference must disclose that the layer is in place to prevent the reaction of a solder material with lower layers of the UBM. If the layer is not in place to accomplish this, than Applicants respectfully submit that the layer may not be reasonably interpreted as a barrier layer. To allege otherwise would amount to ignoring express words of the claim.

In the Mis reference, copper layer 34 is clearly a barrier layer. Figures 2-4 illustrate the UBM layer comprising the chromium layer 30, the phased layer 32 and the copper layer 34. The copper layer 34 is the uppermost layer of the UBM layer and is the layer that comes directly into contact with the solder bumps 42 as shown in Figure 5. Furthermore, Applicants direct attention to col. 5, lines 63-67, wherein it is stated that upon reflowing the solder material 42, the solder reacts with copper layer 34 and the result is the formation of an intermetallic region 34'. Due to the presence of tin in the solder material, the intermetallic region formed may be Cu_3Sn . The copper layer 34 serves its purpose as a barrier layer by preventing the reaction of tin with lower layers of the UBM layer by reacting with the solder material to form the intermetallic region 34'.

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Thus, in Mis, the barrier layer is a layer of copper 34 and the intermetallic region 34' is the result of copper layer 34 acting as a barrier layer. Accordingly, Applicants respectfully submit that the only portion of Mis which may be reasonably interpreted as a barrier layer as recited in claim 1 is copper layer 34, since Mis discloses that the copper layer 34 acts as a barrier layer by forming intermetallic layer 34'.

To the contrary, the Official Action alleges that intermetallic layer 34' is a barrier layer. Applicants respectfully submit that in light of the above discussion, this is an unreasonable interpretation that amounts to wholly ignoring the express words of claim 1. Mis provides absolutely no support for the conclusion that the intermetallic region 34' may be considered a barrier layer as claimed. This is due in part because the intermetallic region does not even exist until after the barrier layer of the UBM reacts with the solder material to prevent the reaction of the solder material and the lower layers of the UBM. Accordingly, Applicants fails to see how intermetallic layer 34' may be reasonably interpreted as a barrier layer when it is not even present on the UBM when the barrier layer is called upon during reflowing.

Furthermore, there is no disclosure in Mis that after the intermetallic layer 34' prevents further reaction between the solder material and the lower layers of the UBM. The reference fails to disclose this because the intermetallic layer 34' only forms after the problem of solder material reacting with lower layers of the UBM no longer exists. That is to say, the intermetallic region is only formed after reflowing has ended and the problem of solder material reacting with lower layers of the UBM is no longer an issue because reflowing has stopped. Regardless of this, the Official Action makes absolutely no disclosure that the intermetallic layer prevents reaction between the solder material and lower layers of the UBM and therefore the intermetallic region may not be considered a barrier layer.

In summary, while Mis discloses a barrier layer made of copper, there is no disclosure of a barrier layer of copper and tin. A barrier layer made of copper and tin is at the heart of the present invention, and the claims are written such that this feature of the UBM is clearly embodied by the claims. By insisting that the intermetallic layer 34' is a barrier layer, the Official Action persists in ignoring elements of the claims and

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refusing to acknowledge the structural limitation imparted to the claims by the recitation of a barrier layer. If Applicants did not intend to claim a barrier layer and the structural limitations imparted to the claims by this recitation, the claims would simply recite a layer of copper and tin. However, Applicants have recited a barrier layer and therefore this limitation must be considered.

Accordingly, because Mis clearly fails to disclose a barrier layer comprising copper and tin as recited in claim 1 of the instant application, Applicants respectfully submit that a §102(b) rejection according to the guidelines set forth in MPEP §2131 has not been established. It is therefore respectfully requested that the rejection of claims 1, 2 and 4 as being anticipated by Mis be withdrawn.

The rejection of claims 3 and 5 under 35 U.S.C. §103(a) as being unpatentable over Mis as applied to claim 1 in view of Michael (US Pat. No. 5,563,102) and the rejection of claim 7 under 35 U.S.C. §103(a) as being unpatentable over Mis have each been carefully considered but are most respectfully traversed in light of the following comments.

Applicants wish to direct the Examiner's attention to the basic requirements of a prima facie case of obviousness as set forth in the MPEP § 2143. This section states that to establish a prima facie case of obviousness, three basic criteria first must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Section 2143.03 states that all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an

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independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Applicants also note MPEP §2143.01, which states in part that, if a proposed modification would render the prior art invention unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Applicants also most respectfully direct the Examiner's attention to MPEP § 2144.08 (page 2100-114) wherein it is stated that Office personnel should consider all rebuttal argument and evidence presented by applicant and the citation of In re Soni for error in not considering evidence presented in the specification.

The rejection of claims 3, 5 and 7 each rely on the faulty assertion that Mis discloses each and every element of claim 1. Furthermore, Applicants respectfully submit that the Michael reference fails to remedy the deficiencies identified above with respect to the rejection of claim 1 over Mis alone. That is to say, Michael fails to disclose the second barrier layer comprising tin and copper that Mis fails to disclose. Accordingly, since neither Mis nor Michael, either standing alone or when taken in combination, disclose or suggest every element of claim 1, Applicants respectfully submit that all claims depending therefrom are also patentable over the references of record. Because the Official Action has failed to establish a proper §103 rejection of claims 3, 5 and 7 according to the guidelines set forth in MPEP §2143, Applicants respectfully request that the rejections of these claims be withdrawn.

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In view of the above comments and further amendments to the claims, favorable reconsideration and allowance of all of the claims now present in the application are most respectfully requested.

Respectfully submitted,
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